

## GOLDSTONE MERCURY RADAR FULL-DISK IMAGING AND RADAR INTERFEROMETRY

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Goldstone full-disk radar imaging of Mercury has been successfully implemented, using the technique developed and implemented at Arecibo (Harmon et al., 1992), with data processing refinements developed at the STAR Lab (Harcke et al., 2000). 3.5-cm images of the Mercury north polar radar-bright features have been produced at 6-km resolution. Data has also been acquired at southern latitudes and is currently being reduced. Further data acquisition on the unimaged hemisphere and the polar regions is planned.

This radar imaging is complementary to Arecibo observations at 13-cm, since future well-calibrated observations at both wavelengths can likely measure (or bound) the thickness of the regolith covering the radar-bright material, and even determine if spatial variation from crater to crater exists in the cover thickness. Comparison of the dual frequency circular polarization ratios may constrain the along-path length of the ice deposits in various craters. (We can only estimate the lengths for H<sub>2</sub>O deposits, since the loss tangent of sulfur at <100 K for microwave frequencies is unknown.) By making simultaneous observations at various incidence angles over multiple inferior conjunctions, we may, in addition, be able to put constraints on the thickness of the deposits. Comparison of 3.5-cm and 13-cm maps may shed light on the nature of a large feature near 57 deg N., 343 deg W., which has been hypothesized to be a possible shield volcano (Harmon and Slade, 1995).

Another application exists for radar "interferometry" by acquiring voltage data when the subradar track crosses over itself within a year or even over multiple years. Such observations can potentially measure the obliquity and amplitude of the forced libration in longitude with extremely high accuracy (Slade et al., 1998). These quantities, in combination with refinement of  $c_{20}$  and  $C_{22}$  by MESSENGER, can determine the radius of Mercury's fluid core.

True radar interferometry on Mercury may be able to generate global topography. The ideal experiment would have Arecibo illuminating the planet with reception at multiple antennas of the Goldstone Complex. At least three Goldstone antennas would be needed to eliminate the north-south ambiguity of normal delay-Doppler imaging. Simulations of such observations will be presented.

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